Forensics Headstart Year 9 2015

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Form\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

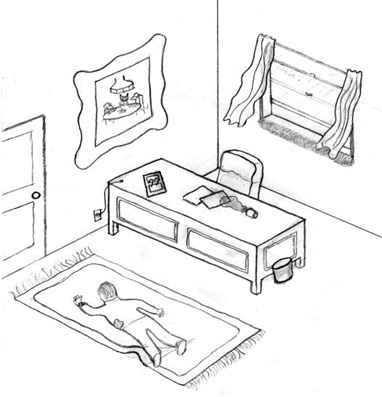
Forensic Science relies on observations, scientific testing and interpretations to determine what has happened at a crime-scene.

• Observations are different from interpretations. Observations are descriptions of things we see.

• Interpretations are stories about what happened that are based on the observations.

Events that happened in the past are similar to events that we observe today. They follow the same laws of physics.

Throughout this Headstart program you will be required to complete a number of tasks in order to gain knowledge about skills used in forensic science. When you see this symbol you have a **task** to complete

***Making Observations***:

Look at the picture to the right and:

a). Record your observations:

b). Make some interpretations:

***Can you solve it?*** As you watch the PowerPoint record your answers to the following:

1. Did the stork steal the items? Why/why not

2. What were Slylock’s observations? So who was the litterbug?

3. Which owl painting is fake? Explain your choice.

4. (Dog & Cat) List the 6 differences in these 2 pictures

5. (Monkey & Cat) List the 6 differences in these 2 pictures

6. (Parrot & Gorilla) List the 6 differences in these 2 pictures

7. Mystery items to name: 1= 2= 3= 4= 5=

6= 7= 8=

8. (Duck & Girl) List the 6 differences in these 2 pictures

9. (Cat & Pool) List the 6 differences in these 2 pictures

10. Fingerprint answers: 1= 2= 3= 4= 5=

11. Types of Scientist:

12. Mystery items to name: 1= 2= 3= 4=

13. Slicks appearance shows:

After correcting your answers how do you compare (as a forensics expert) to your partner? Discuss

***Crime Scene Report***

******At approximately 7.15 am Friday morning, Ms Kosack the Year 7 Science teacher thought something was fishy as she walked down the corridor and noticed the door to S2 was open. She walked into the classroom and immediately discovered that the aquarium was empty and her prized clown fish Nemo was missing. Beside the fish tank was a hand written note. Dirty footprints of a barefoot burglar led to an open window. Bits of a white powdery substance were found in front of the aquarium which had blood stains on the side of the glass. When police arrived the immediately began to gather forensics evidence.

If you were with the forensic police what **evidence** would you have collected? Make a list.

***Suspects***

The suspects you will investigate throughout this unit are shown in the table. Using the clues found at the crime scene (the ink on the note, soil found on the shoes, white powder, blood type, fingerprint and foot print), determine which of these four suspects is the “barefooted burglar”. What do you think was the motive for the crime? Your assessment will be a collection of your evidence and the final result of your findings.

|  |  |  |  |
| --- | --- | --- | --- |
| Suspect 1 | Suspect 2 | Suspect 3 | Suspect 4 |
| Lou Lou | Dan the Man | Peg the Leg | Jack the Jock |
|  |  |  |  |
| Profile | Profile | Profile | Profile |
| AGE 25 | 32 | 35 | 27 |
| GENDER Female | Male | Female | Male |
| OCCUPATION Food Teacher | handyman | Biology Teacher | PE teacher |
| Motive: May have wanted to fatten the fish up and then cook him | Had an opportunity to sell the fish to a friend who worked in the seafood business | Needed a birthday gift for her son and didn’t have time to go shopping at Southland | Thought that he wasn’t getting enough exercise in the small tank and wanted to free Nemo… |

***Decode the note***

******Your teacher will supply you with a copy of the note left at the scene (part of it is shown below)

Your task is to decode the note.

|  |
| --- |
|  |

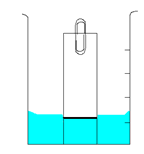
***Discover the hidden colours in a black marker***

Chromatography is a method of separating out materials from a mixture. Ink is a mixture of several dyes and therefore we can separate those colours from one another using chromatography. When ink is exposed to certain solvents the colours dissolve and can be separated out. When we expose a piece of paper with ink on it to a solvent, the ink spreads across the paper depending upon the size and properties of its components/pigments.

******The pattern produced is called a chromatograph. Some inks are water-soluble, so you can use water as the solvent. Inks which are not water soluble are often alcohol-soluble and you can use Isopropyl alcohol as the solvent.

Follow the instructions below to discover which pen was used to write the ransom note

**Materials**: Filter paper, water, 4 black markers, 4 beakers, ruler

**Method**:

1. In the middle of each piece of filter paper, draw a line of ink across the width about 2cm from the bottom with one of the pens. Repeat until all inks are on their own piece of paper.
2. Half fill each beaker with distilled water.
3. Place each piece of filter paper into the beaker so that the end just touches the solvent and clip at the top. Watch as the water flows upwards and bands of colours separate out.
4. Allow the inks to separate until the water is within 2 cm of the top. To analyse the results, calculate the Retention Factor, Rf of each colour band.
5. Use the following formula to calculate Rf values:

**Results:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Pen #** | **Number of colour bands** | **Colours present** | **Rf values** |
| **1** |  |  |  |
| **2** |  |  |  |
| **3** |  |  |  |
| **4** |  |  |  |
| **Ransom letter** |  |  |  |

**Discussion**:

1. Using your understanding of colours, explain why mixing many colours of ink together make black

2. Which of your known suspect pens is the pen used to write the note?

**http://static.arttoday.com/thm/thm11/CL/5344_2005010018/000803_1058_62/21857103.thm.jpg?000803_1058_6219_v__v*SOIL pH TESTING***

**Aim**: To identify the suspect who walked through the scene of the crime using the pH of the soil on their shoes matches the pH of the soil found at the crime scene.

Theory: Scientists use litmus paper or a meter to measure the “pH” of the soil. Any substance which has a pH value of less than 7 is considered an acid, and a pH value greater than 7 is a base. This leaves a pH of exactly 7 being neutral.

0 ——————7——————14  
ACID———NEUTRAL———BASE

**Materials**:

4 soils samples Soil test kit Soil from crime scene Magnifying glass

****

**Method**:

1. Collect a small soil sample (about 1 teaspoonful) and mix it with a small amount of a chemical provided.

2. Then sprinkle the mixture with the special powder provided.

3. The powder will change colour and you then match the colour of your sample with the colour on the card included in the kit. The card will tell you what the colour means. If the pH is low (6 or below) then your soil is acidic. If it is above 7, the soil is alkaline (basic).

4. Using a magnifying glass, observe the soil and note the colour, particle size and any other noticeable features.

Results:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Soil Sample** | **pH Test 1** | **pH Test 2** | **Magnifying glass observations** | **Match?** |
| **Crime Scene** |  |  |  |  |
| **1** |  |  |  |  |
| **2** |  |  |  |  |
| **3** |  |  |  |  |
| **4** |  |  |  |  |

Discussion:

1. Other than using soil pH to work out where the soil originated from, what other purposes can you see for this test?

2. This soil testing kit is available in the nursery for gardeners to purchase. Why would a gardener wish to test the pH of the soil in their garden?

3. Why is getting the correct pH important for plants?

4. Whose shoes have soil which matches the soil found at the scene of the crime?

***FINGERPRINTING***

Watch the PowerPoint on Fingerprints then complete the following table:

|  |  |  |  |
| --- | --- | --- | --- |
| Fingerprint characteristic | Whorl | Arch | Loop |
| Diagram |  |  |  |

**Aim**:

To use an inkpad and take fingerprints to learn how to identify and classify the three types of fingerprints. (Before you begin you will need to look at the Fingerprints PowerPoint.)

**Materials**:

Inkpad and worksheet provided



**Method**:

Firmly grasp your partner’s right hand and roll a finger from left to right over the inkpad.

While still holding the person's hand and finger, transfer the print to the chart by placing the left side of the finger on the chart, rolling the finger to the right, and then lifting the finger STRAIGHT up to avoid smearing the print. Repeat with all fingers of both left hands.

**Discussion & Conclusion:**

1. How do your fingerprints fit with the statistics on fingerprint types? i.e. Arches 10%, Whorls 30%, Loops 60%?

2. Can you identify a delta in one of your prints? Label it. Do you have any mixed prints?

******

***Fingerprint research*** (once you have collected your prints, choose 5 questions from the list– and answer them)

1. What is the name given to the study of fingerprints?
2. What is the function of the ridges on our fingers which create fingerprints?
3. What causes fingerprints to be left behind when we touch things?
4. Which of the following is NOT one of the three basic types of fingerprint patterns?
5. At what age do human beings acquire fingerprints?
6. Which of the following statements about fingerprints is NOT true?
7. Which animal is said to have fingerprints virtually indistinguishable from those of human beings?
8. Why is it usually impossible to obtain fingerprints from textiles such as fabric, clothing and carpet?
9. Who is generally recognised as being the first person to use fingerprints as a means of identification?
10. What is the minimum number of matching points required to identify an unknown latent print?

***THE FEET CAN MEASURE THE HEIGHT***



The bones of the feet can give an estimate to a person’s height. List the individuals’ name, height, and foot length. Have some adults remove their shoes and measure their height. Measure the length of the adult's **left** foot and complete the table below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Height of Person cm (H)** | **Foot Length cm (F)** | **L/H × 100 =** | **Approximate rule? H =** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Examine the numbers. Do you see a pattern? Write a mathematical rule that approximately connects Height to Foot Length.

Divide the length of each person's left foot by his/her height. Multiply the quotient by 100. What do you get?

The results of your calculations should be about 15, illustrating that the length of a person's foot is approximately 15 percent of his or her height.

****http://static.arttoday.com/thm/thm14/CL/3D/041906_1/33384473.thm.jpg?private_eye_following_tracks_pt_resWhen a forensic scientist knows the length of a foot, the forensic scientist will be able to approximate the height of the individual. This works best on a full grown individual for the ratio of body parts is slightly different in growing children.

**Write a rule to describe the relationship between foot length and height.**

**RULE: Height =**

We can later use this information to work out the height of the person who visited the scene of the crime…Because these are shoe prints and not foot prints; we will take 2cm off the shoe print length to get the length of the footprint.

eg. Shoe print is 31cm; foot print is 31-2 = 29cm.

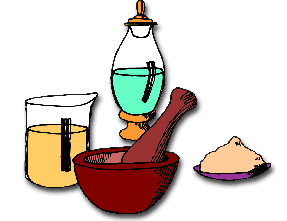
**Complete the following table:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name or suspect** | **Foot length in cm (take 2cm off the footprint size)** | **Multiply by 100** | **Then divide by 15** | **Approximate Height in cm** | **Actual Height** |
| Crime Scene |  | 100 | 15 |  |  |
| Suspect 1 |  | 100 | 15 |  |  |
| Suspect 2 |  | 100 | 15 |  |  |
| Suspect 3 |  | 100 | 15 |  |  |
| Suspect 4 |  | 100 | 15 |  |  |

Visit the crime scene and *carefully* – without disturbing any evidence, measure the length of the footprint there. Calculate the height of the person who visited the scene of the crime. Which suspects fit this description??

***WHAT IS THAT WHITE POWDER?***

Detectives have collected a range of white powders from each of the suspects’ desks. By testing the chemicals with known chemicals, their identity can be determined.



**Materials**:

White chalk/powders White paper Magnifying glass Spatulas

Water Acids Iodine solution Bunsen burner

**Method**:

Part A: Appearance:

Place a spatula of one of the 5 white powders on a sheet of black paper.

Study the powders with the magnifying glass. Examine what each powder looks like. Does it have large or small grains? Examine the powders further by rubbing each powder between your fingers. Describe how each powder feels in the Texture column of the chart.

Determine if there is a smell to any of the powders.

j0339450Part B: Test with water:

Pour a small amount of water into 5 test tubes

Add a different powder to each test tube

Examine what happens. Do the powders dissolve? Is there a reaction?

j0291035Part C: Test with acid:

Pour a small amount of acid into 5 test tubes

Add a different powder to each test tube

Describe what happens to each powder and if there is a reaction of any kind.

Part D: Test with Iodine: *Iodine should be handled with care*

Place one-half spatula of each powder in a separate test tube.

Add 2 drops of iodine to each jar using the eyedropper.

j0346565 Test E: Testing with Heat

****Place a small amount of each powder in an evaporating basin.

Carefully heat with a Bunsen burner over the blue flame

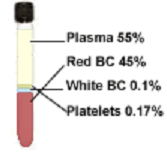
**Observations**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Substance / test | Suspect 1 | Suspect 2 | Suspect 3 | Suspect 4 | Crime scene |
| Appearance |  |  |  |  |  |
| Texture |  |  |  |  |  |
| Smell |  |  |  |  |  |
| Reaction in water |  |  |  |  |  |
| Reaction in acid |  |  |  |  |  |
| Reaction in Iodine |  |  |  |  |  |
| Reaction to heat |  |  |  |  |  |

**Discussion & Conclusion**

1. After analysing and recording results of each substance can you correctly identify the mystery powder?

2. Does the mystery powder match that of any if the suspects?

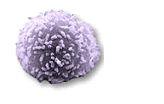
***Whose Blood Is It?***

Theory:

The average adult has about five litres of blood coursing through their vessels, delivering essential nutrients and oxygen, and removing harmful wastes. Without blood, you die!

Blood cells are produced in the [bone marrow](http://en.wikipedia.org/wiki/Bone_marrow).

**Blood consists of four components:**

**Plasma** is a mixture of water, sugar, fat, [protein](javascript:glossary('protein');), and potassium and calcium salts. More than 92% of plasma is water.

**White blood cells** are clear round cells that produce proteins called [antibodies](javascript:glossary('antibodies');) that fight infections caused by bacteria, viruses, etc.

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**Platelets** gather at the site of the injury and stick to the edges of the wound. They release chemicals to create clots to stop bleeding.

****

**Red blood** [**cells**](javascript:glossary('cell');) contain a special protein called [haemoglobin](javascript:glossary('hemoglobin');), which carries the oxygen we inhale with our lungs to all of the parts of our bodies. It then returns carbon dioxide from our body to our lungs so we can exhale it. Haemoglobin is also responsible for making red blood cells red.

**Blood Groups**

There are 4 main blood groups: A, B, AB and O. The blood groups depends upon the 'antigens' present on red blood cells and the 'antibodies' present in the blood plasma. Antibodies are proteins that bind to anything that the body does not recognise so the immune system can destroy it. An antigen is any protein or carbohydrate molecule that can be recognised by the immune system.

To test blood types, antibodies are added to a sample of blood and if it **Agglutinates** (forms clumps) then that antibody indicates the blood group of the sample.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BLOOD TYPE Phenotype** | **BLOOD TYPE Genotype** | **Red Blood Cell Antigens** | **Plasma Antibody** | **Reaction with Antibody A** | **Reaction with Antibody B** |
| A | AA or AO | A | Antibody B | Agglutinates | None |
| B | BB or BO | B | Antibody A | None | Agglutinates |
| O | OO | Neither | Antibody A & B | None | None |
| AB | AB | A & B | None | Agglutinates | Agglutinates |

****

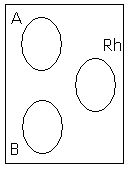
**Rh factor blood grouping system**

This is also an antigen on the red blood cell’s surface. Those who have it are called Rh+. Those who haven't are called Rh-. If you are Rh-, you can only receive RH- blood. If you are Rh+, you can receive either type.

|  |  |  |
| --- | --- | --- |
| RHESUS FACTOR | + Test | - Test |
| Rh+ in blood | No agglutination | No agglutination |
| Rh- in blood | Agglutination | No agglutination |

If the wrong blood type is given (put into) a non-compatible blood type, it will agglutinate (*react by clumping together)* and the recipient could die due to clumps forming in their blood vessels.

**Aim**:

To test the blood of the four suspects to see whose is a match to the blood type B+ found at the crime scene.

**Materials**:

4 Plastic trays 4 blood samples 3 toothpicks

Anti A, Anti B and Anti D (Rh) serum

**Method**:

Add 2-3 drops of Sample 1 to each well in one of the trays. Label the tray Sample 1.

Add a few drops of Anti A to well A and mix with a toothpick.

Add a few drops of Anti B to well B and mix with a toothpick.

Add a few drops of Anti D to well Rh and mix with a toothpick.

Record your results in the table below and work out the blood type using the ABO Blood Groups and their reactions table from your notes.

Repeat steps 1-5 for Sample 2, 3 and 4.

**\* Please DO NOT throw out the plastic trays & toothpicks. Rinse them and put in sink \***



Results:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Blood**  **Sample** | **Reaction to Antibody A** | **Reaction to**  **Antibody B** | **Reaction to**  **Antibody D (Rh)** | **Blood type** |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 4 |  |  |  |  |
| Crime scene |  |  |  |  |

**Discussion**:

1. If the blood in only well A reacts, then the blood type is \_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. If the blood in only well B reacts, then the blood type is \_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. If the blood in both well A and B react, then the blood type is \_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. If the blood in neither well reacts, then the blood type is \_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. If the blood in well Rh reacts, then the blood type is \_\_\_\_\_\_\_\_\_\_\_\_\_

6. If the blood in well Rh does not react, then the blood type is \_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. Which of the blood types do you think might be called a “universal donor”? Explain why.

8. Which of the blood types do you think might be called a “universal recipient”? Explain why.

**Conclusion**:

The blood type of the blood found at the scene of the crime was found to be \_\_\_\_\_\_\_\_\_\_\_. This blood type matches that of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

***Finally,***

|  |  |
| --- | --- |
|  | Using the clues found at the crime scene, determine which of these four suspects is the "barefooted burglar"? What do you think was the motive for this crime? Write the results of your findings and convince a jury of your peers. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Evidence collected | Suspect 1 | Suspect 2 | Suspect 3 | Suspect 4 |
| Lou Lou | Dan the Man | Peg the Leg | Jack the Jock |
|  |  |  |  |
| Pen ink |  |  |  |  |
| Soil in shoes |  |  |  |  |
| Fingerprints |  |  |  |  |
| Height |  |  |  |  |
| White powder |  |  |  |  |
| Blood type |  |  |  |  |